PRF Ambiguity Determination for Radarsat ScanSAR System

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* The research described in this paper was carried out by the Jet Propulsion Laboratory, California Institute of "technology, under a Contract with the National Aeronautics and Space Administration.

Abstract

PRF ambiguity is a potential problem for a spaceborne SAR operated at C-band or higher carrier f requencies. For a strip mode spaceborne SAR, several approaches were proposed to solve this problem. These include the multiple PRF algorithm, residual range migration algorithm, and wavelength diversity algorithm. Among these algorithms, the residual range migration algorithm is scene dependent. it works only when high frequency and high contrast features exist, The wavelength diversity algorithm is, however, applicable to any area with reasonable signal-to-noise ratio. In fact, it has better performance over a homogeneous area than areas with sharp features. The multiple PRF algorithm is applicable when the Doppler drift rate is limited. The disadvantage of the multiple PRF approach is that extra data take is required at the start of each data collection period.

The Radarsat ScanSAR is operated **in a burst mode. The nature of signal** processing for a burst mode SAR is quite different from that of a strip mode SAR. Therefore, one must device PRF ambiguity determination algorithms suitable for the burst mode SAR. Again, there are three candidate algorithms for a burst mode SAR for PRF **ambiguity determination. First, the wavelength diversity algorithm without any** modification can still be applied to a burst mode SAIL A range cross-correlation algorithm conceptually similar to the residual range migration algorithm will be a second candidate. The last candidate is double PRF algorithm using the beam overlapped data to determine the PRF ambiguity number.

This paper gives detailed description for both range cross-correlation algorithm and double PRF algorithm. The performance of all three candidates are anal yzed. For a 500 km x 500 km image frame, a limited number of bursts are selected for processing to determine its PRF ambiguity number as well as the 1 Doppler and range centroid frequencies. A quality assurance step is suggested to optimally use all the results from these data based on three algorithms.

Keywords: Doppler centroid, PRF ambiguity, ScanSAR, SAR burst, wavelength diversity, range migration, multiple PRF, sub-swath, and integration time.